Hybrid Finite Element Analysis for Rotorcraft Interior Noise Simulations, Phase II

Completed Technology Project (2009 - 2013)

Project Introduction

One of the main attributes contributing to the competitiveness of rotorcraft, is the continuously increasing expectations for passenger comfort which is directly related with reduced vibration levels and reduced interior noise levels. Such expectations are amplified in the VIP market where people are used in the acoustic and vibration levels of civil and executive jets.

Anticipated Benefits

Structural-acoustic concerns are present in rotorcraft, aircraft, launch vehicles, and crew modules since they are directly related with occupant comfort and noise induced vibration on payloads and electronic equipment. In all of these areas simulations are utilized during design. Currently, structural-borne paths are difficult to address, since the excitation propagates through the stiff load bearing members to the flexible panels and capturing the behavior of both within the same simulation model is challenging. The proposed Hybrid FEA innovation will allow including structure-borne noise simulations within a multidisciplinary design environment and it will enable the evaluation of advanced concepts and reaching cost and weight savings. Therefore, the proposed developments will be useful to all NASA groups and contractors interested in reducing weight and cost when designing rotorcraft, aircraft, launch vehicles, and crew modules. Structure-borne interior noise or radiated noise concerns are present in Naval applications where mechanical excitation from the propulsors is transmitted through stiff foundations to the outer hull of a vehicle; in automotive applications structure-borne noise comprises a major issue due to excitation applied at the shock towers from the suspension system, or due to excitation applied at the engine mounts of the vehicle's subframe from an operating engine; in heavy construction equipment excitation from the engine and the hydraulic system is transmitted through the load bearing structure to the interior cabin. In all of these areas simulations are utilized during design. Therefore enabling structure-borne noise computations and linking them with other simulation models within a multidisciplinary environment will offer cost and weight savings. Thus, there is a great commercial market potential for the outcome of this SBIR.

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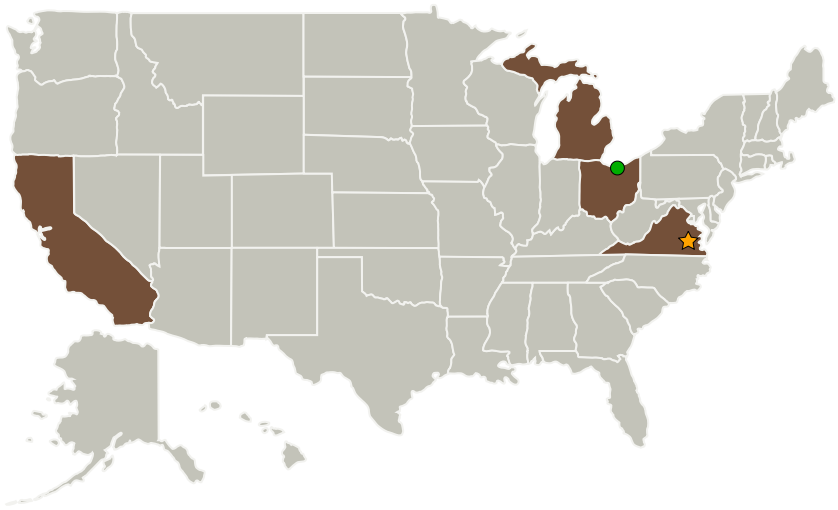
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
●Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio
Michigan Engineering Services, LLC	Supporting Organization	Industry Women-Owned Small Business (WOSB)	Ann Arbor, Michigan

Primary U.S. Work Locations	
California	Michigan
Ohio	Virginia

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Gary C Jahns

Principal Investigator:

Geng Zhang

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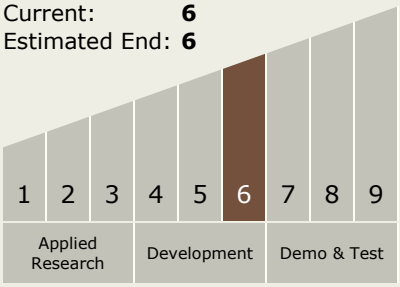
Project Transitions

December 2009: Project Start

May 2013: Closed out

Technology Maturity (TRL)

Start: **6**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.4 Aeroacoustics